5. TUNING THE IRONER FOR QUALITY AND PRODUCTIVITY

A motor car which has not been serviced will stagger along for quite a long while but its performance will gradually fall off and the miles per gallon will get poorer and poorer.

A modern ironer resembles a motor car in respect of its need for careful tuning and in this section we look at exactly what is involved. A newly tuned ironer will probably yield startling returns for very little effort, especially if it has not been tuned in the last twelve months.

When an ironer is moved from one location to another the disturbance will almost certainly upset many of the settings and when the unit is recommissioned every one of these needs to be checked if the original performance is to be matched or bettered.

5.1 Bed and roller alignments

An ironer is designed to operate with the beds and rolls exactly horizontal, side to side and front to back. This is best achieved by mounting it on a perfectly **level** base.

The beds need to be exactly **parallel** to each other and this is well worth the time and effort it takes. There may be a reference point on each bed to facilitate this.

If the beds and rolls have varying diameters to achieve a progessive increase in surface speed then it is vital that they are assembled in the correct **order**.

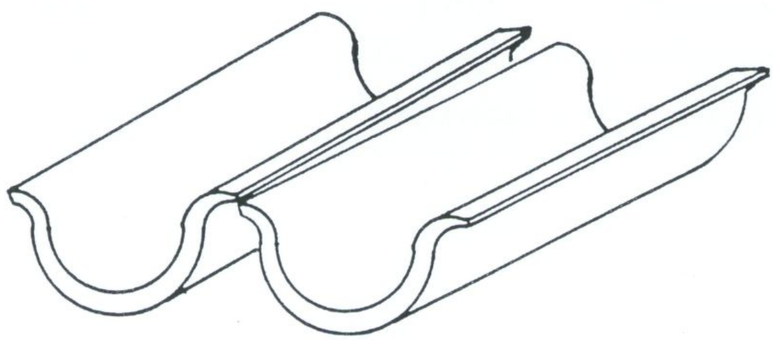


Diagram 30: Ironer beds incorrectly aligned

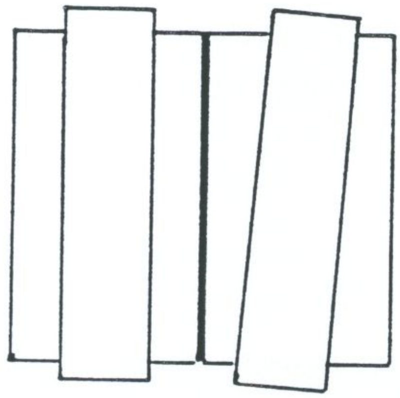


Diagram 31: Ironer roll incorrectly aligned with bed

Once the beds are correctly positioned the rollers then need to be set exactly in line with the beds and exactly in line with each other. There is no point in working from the outside of the clothed surface - measurements must be taken from a metal reference on the shaft or roller itself. Once the beds and rollers are correctly aligned then the rest of the components can be matched to these. Care should be taken to measure everything from a common reference point wherever possible and the tolerance allowed should be less than 1mm.

5.2 Steam supply

The steam supply needs to be at the **maximum** pressure available, taking into account the fabrics to be processed (see section 6). The bore of the supply pipe needs to be large enough to carry the design flow rate without undue pressure loss.

The steam pressure must be maintained consistently and if this presents a problem it needs to be solved as a matter of urgency - the ironer will not perform properly otherwise. Standard techniques are available for smoothing out washer extractor steam demand and these should be implemented.

The steam supply should be **dry** at the entry to the ironer and if this cannot be achieved at source, then a suitable water separator should be installed.

It is good practice when planning the installation of the ironer to try to ensure that the steam connection from the main is taken from the top of the main pipe and that the ironer is situated as close to the boiler as possible. This will ensure that full advantage is taken of the maximum boiler pressure and that the steam will be dry and at maximum temperature.

The steam supply to the ironer should if possible be taken from the steam main before the supply to any other equipment to reduce pressure fluctuations.

5.3 Condensate discharge

The **steam traps** on an ironer are vital to its economic and effective performance and should be checked regularly - at least every four weeks.

Steam trap **blockage**, either within the trap itself or at the pre-trap filter, will cause total or partial failure to discharge condensate from the bed concerned. This will lead to that bed ceasing to function, with significant reduction in ironer performance and output.

The steam traps fitted should be capable of **venting air**. If this is achieved, as in a float trap, by installing a small thermostatic vent within the trap itself, then this needs regular checking for blockage or corrosion (which allows leakages). A blocked air vent leads to **air blanketing** of the heat transfer surfaces and loss of performance. A leaking air vent leads to steam wastage and a significant increase in ironer operating costs.

If a slug of steam is trapped in the pipe between the bed and the steam trap, this can prevent condensate following into the trap until the slug of steam condenses. This phenomenon is called **steam locking** and a good float trap fitted to the bed of an ironer will normally have a steam lock release facility. This needs the occasional check to ensure that it is clear and unblocked so that the problem never arises. The symptoms are generally the same as those for partial trap blockage.

Some steam traps work best with a head of condensate between the bed and the trap, which is why traps are usually fitted at a slightly lower level than the base of the beds. A gap of up to 45 cm below the bed base and the top of the trap is usually beneficial.

When an ironer is working at its maximum output, especially with cold wet cotton sheets, then it is important that the **size** of trap fitted is capable of handling the condensate flow rate. Failure to check this simple detail is behind the poor performance of many ironers and usually arises because in an emergency a faulty trap has been replaced with the only spare conveniently to hand and the 'temporary' replacement has become permanent.

Mention was made earlier in this handbook of the problems created by high back pressure in the condensate main. There are various ways of checking this - the force behind the plume of steam from the boiler feed tank is often one indication - but by far the best means is to connect a small pressure gauge into the condensate line immediately after the ironer or at some other convenient point, especially if this cause of poor performance is suspected. Typical condensate main pressures are in the region of 0.7 - 2.0 bar (10-30 psi).

5.4 Air Venting

In addition to air and other non-condensables being vented through the steam traps, it may be necessary to vent air directly from the '**horns**' of the beds themselves. Special air vents are supplied for this purpose which discharge into the condensate main and ensure that the vapour in the ironer bed consists only of pure condensing steam. This will give the maximum heat transfer and hence the fastest drying performance. An air vent can be checked for correct functioning in exactly the same way as a steam trap using an appropriate steam trap leak detector. The small hand held units of the **ultrasonic** type are probably the simplest and easiest to use for this purpose.

5.5 Bed temperature

Once all the checks have been made on the steam and condensate system, including air vents, then a final check should be made of bed temperature. Theoretically the surface temperature of the metal should approach the temperature of the condensing steam. This target temperature can be read off the chart in Section 2 and can be checked using a digital thermometer with a surface contact probe. Placing a little insulating putty over the probe when making the measurement will improve the accuracy.

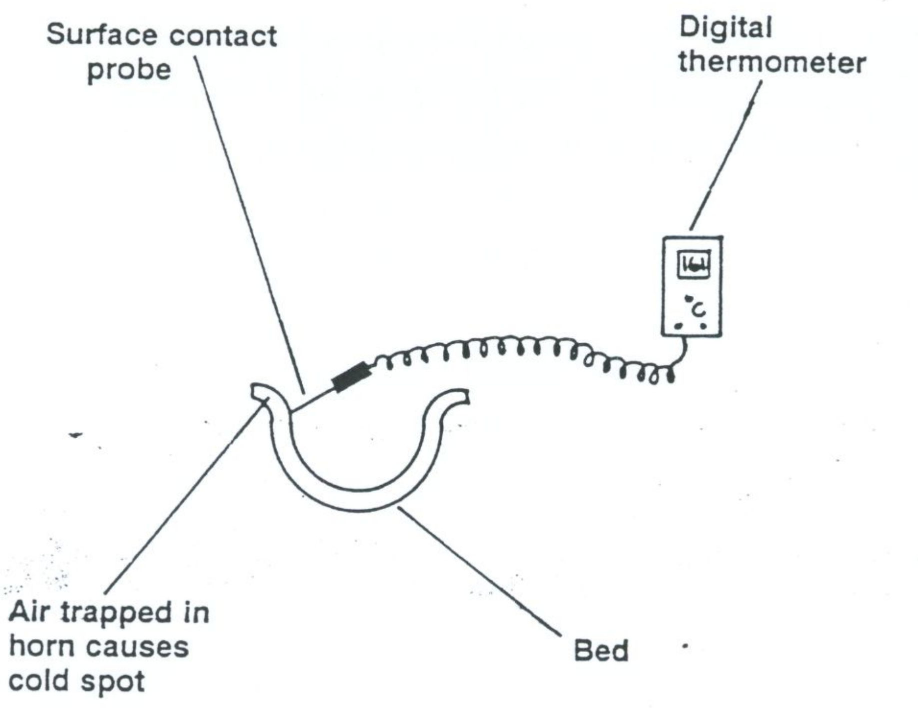


Diagram 32: Checking for cold spots on the bed

The measurement needs to be made at several points across each bed. If the systems are working correctly then all the temperatures should be within 2-3°C of each other with no cold spots and the average should be within about 5°C of the condensing steam temperature.

5.6 Clothing and springs

When the ironer is reclothed a check should be made that the springs are all in good condition, with no breakages and plenty of resilience. The height of the sprung surface should be the same from side to side of the ironer.

The clothing itself should be clean and resilient to give a uniform diameter across the roll with no grooves or ridges. This diameter should exactly match the diameter of the bed when the unit is running at temperature and the manufacturer's metal tape should be available to enable this to be checked precisely.

If the rolls are intentionally of different diameters then the correct tape must be used to check each one. Some machines are supplied with a single tape which has different marks for each roll.

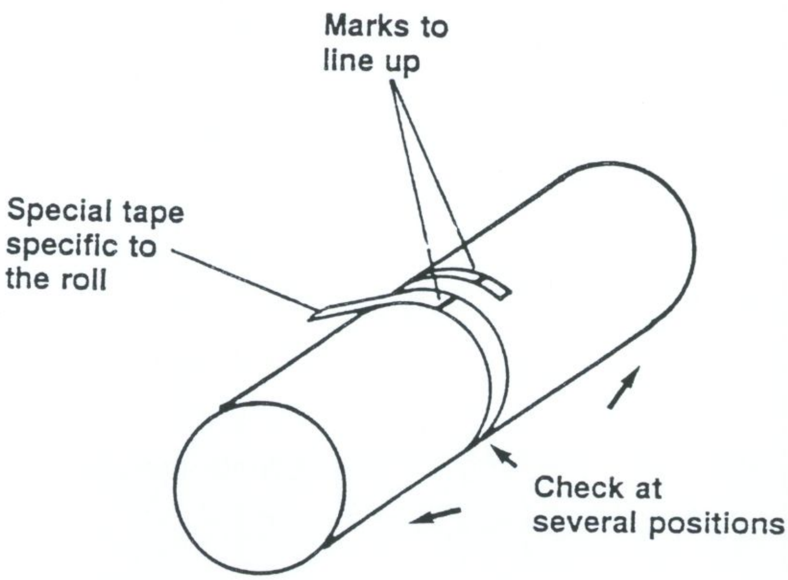


Diagram 33: Checking diameter of clothed roll

If the clothing is hard and compacted or if it is ridged or grooved, or if the surface is heavily charred, then the rolls should be reclothed - to delay this is false economy because it wastes production time and increases running costs.

5.7 Vacuum exhaust

When the wax cloth is run through an ironer the suction exhaust should be turned off to avoid wax vapours being drawn into the suction system. If this is not done then a build up of wax occurs in the suction exhaust ducting and at the suction fan. It is therefore essential to check this from time to time and to remove any deposits found. If this is not done then the suction performance of the ironer will be reduced, resulting in poor removal of water vapour, soggy clothing and damp work coming off the ironer.

Some manufacturers do not make provision for the suction fans to be turned off during waxing. If the owner of one of these units encounters the problem of wax build up on fan blades and in exhaust ducting then it may be necessary to modify the electrical control system. This is a skilled operation normally requiring a qualified specialist.

It is usually the front roll of the ironer which has the most heat transfer to achieve because the sheet is very wet and conducts heat quickly through the water it carries. The next roll has rather less work to do and at the third and subsequent rolls, the rate of heat transfer is probably secondary to the time taken for water vapour to diffuse out of the centre of the cotton yarns.

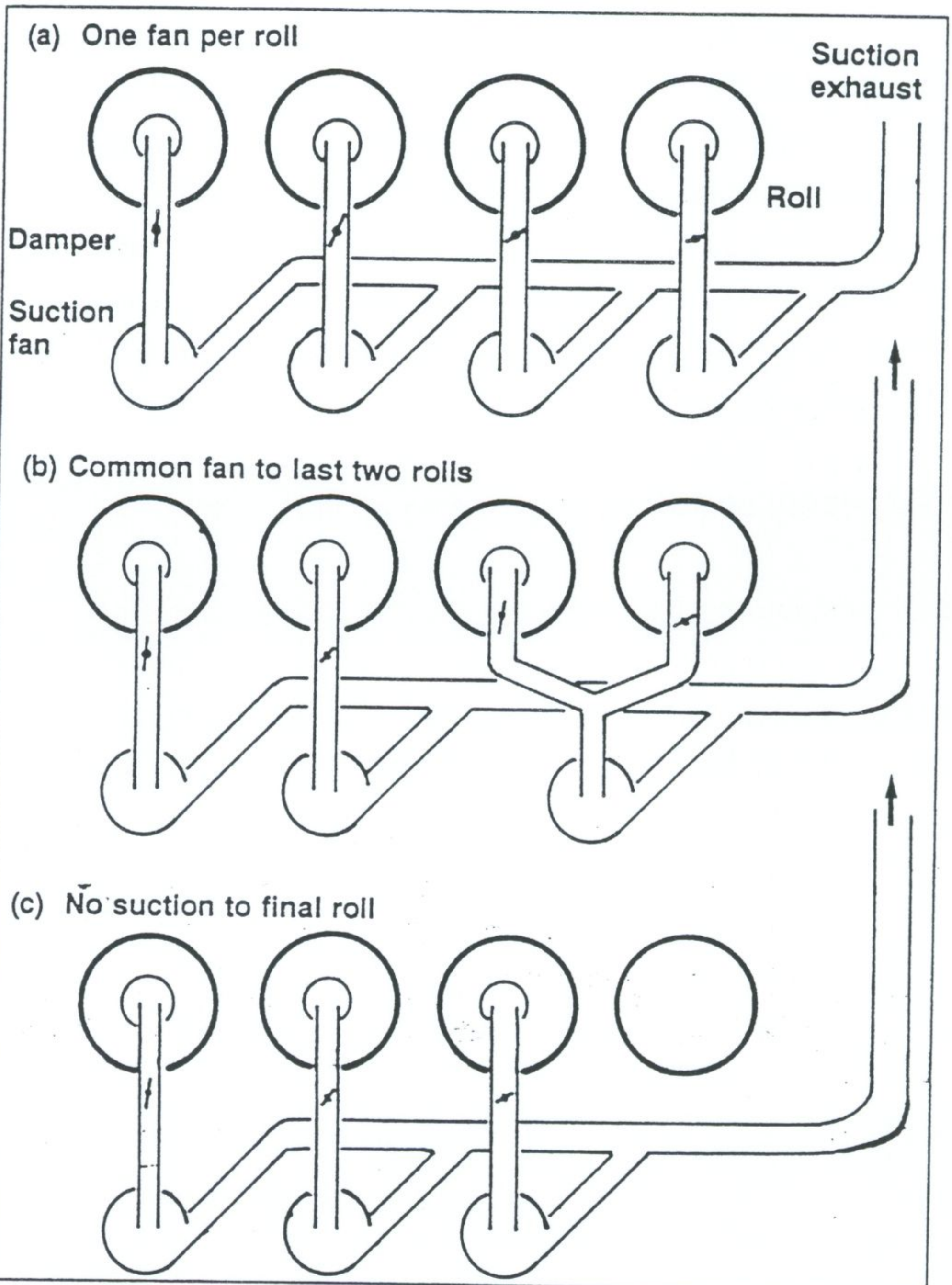


Diagram 34: Various roll vacuum arrangements

This means that the vacuum suction must be carefully balanced between the rolls, so that the water vapour can be drawn efficiently clear of the front roll, whilst still leaving adequate air flow at the second and subsequent rolls. The ironer manufacturer will generally pre-set the settings of the dampers in the suction lines from each roll and reference must be made to the manufacturer's manual for correct settings for these. If it is decided to adjust these differently from the recommended settings this should only be done after a carefully conducted and monitored trial.

5.8 Waxing

A waxing cloth should be available capable of coating the beds with the correct grade of proprietary wax. A suitable supply of wax must be purchased and kept for this specific purpose. A well designed waxing cloth has a flap beneath which the wax is placed and a non-metallic scouring pad on the under surface.

5.9 Drive control

Conventionally, the speed of an ironer is defined as the surface speed of the **first** roll.

The accuracy of the speed control mechanism should be checked at commissioning and every month or so, because this is the main control used by the operator to reset the ironer for different classifications of work. Speed controllers can drift a little so that the speed set up by the operator is not actually achieved in practice. This can result in the ironer running more slowly than planned, with unexpected loss in productivity, or running at a higher speed resulting in unexpectedly damp sheets which have to be put through again.

If there are differential speeds on each roll achieved by varying the roll diameter then the maintenance of the clothing should have established these correctly. If the speed differentials are achieved in any other way they will need to be checked precisely, otherwise there is a real risk that work will be stretched unnecessarily, or alternatively flatness and drying performance will both be poor.

5.10 Air operated devices

Finally a check should be made of the compressed air supply pressure, quantity and quality. The air should be dry and it is good practice to put an automatic water drain point immediately before the ironer itself. Pistons and air operated valves will benefit from correct lubrication and many operators put an in line oiler at the ironer for this purpose. However, there should certainly not be an excess of oil or any other contaminant in the air-line which can cause marking of the sheets at the air jets on the folder.

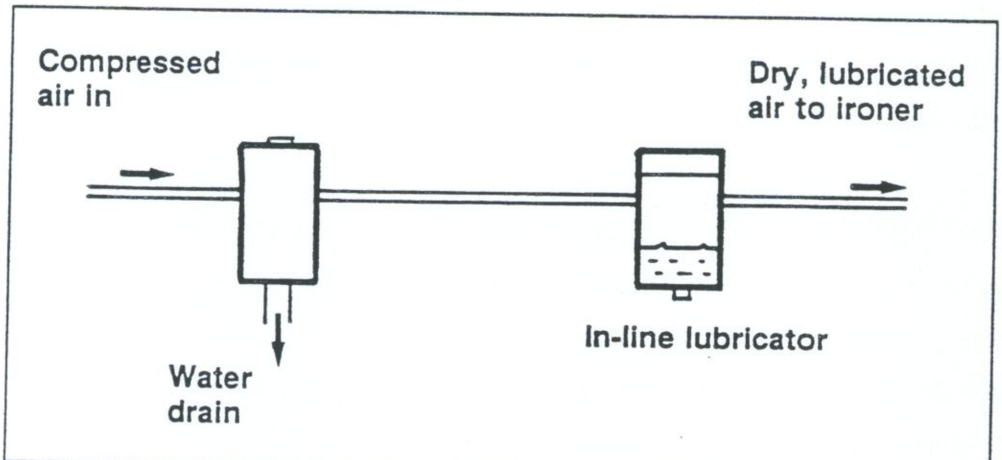


Diagram 35:
Treatment of compressed air for use in air operated rams for roll/bed lifting

Tuning an ironer using the information contained in this section can be quite a revelation, especially if it has not been done for some time. Although most of the adjustments will result in only a small improvement, when these are all added together it is frequently possible to bring an old unit close to 'as new' performance.

6. EFFECT OF FABRIC CHOICE ON IRONER PERFORMANCE

6.1 Cotton

Ironers are generally designed to handle cotton sheets with a moisture retention of 54-56%. However, some rental operators use varying qualities of cotton sheets and this can have quite a significant effect on ironing speeds attainable.

The recommended mainstay of the textile industry in the 1970's and 1980's was based around cotton sheeting using yarn of 18's count with 60 threads per inch in both directions. Many rental operators now use a thinner, lighter sheeting, woven from cotton yarn of 20's count provided the customer will accept this. This lighter fabric is slightly more difficult to finish and requires much tighter tolerances in setting up the ironer and in making feeder and folder adjustments, but it can be processed at higher throughput.

6.2 Polyester-cotton

Many contract laundries handling customers' own sheets process polyester cotton material as a matter of course. The moisture retention on this work is much lower than with 100% cotton, so that the ironer can be run much faster. Even then it is often necessary to reduce the ironer temperature and this must be done by an appropriate steam pressure reducing valve or similar means. Otherwise there is a real risk of over drying polyester cotton and producing a considerable static charge on the fabric. This causes the material to cling to rollers and belts instead of following the correct flow path and produces quite unwanted snarl ups and damage in the process.

One way of avoiding static is to adjust the ironer speed so that there is still a little humidity in the sheet when it comes off the folder. Cotton has a natural moisture content of about 8% and this is usually sufficient to conduct any static charge safely away. Striking the right balance between overdrying and dampness requires careful adjustment and consistency.

In extreme cases it may be necessary to incorporate a suitable softener into the final stage of a wash process, or even to fit a static elimination bar at the critical point on the ironer itself. Some operators, rather than reduce steam pressure, deliberately reduce the extract time for polyester cotton sheeting so that the incoming moisture level of the sheet is higher than it otherwise would be. On some washer extractors it is possible to reduce the rotational speed of the cage for the final extract with the same result.

6.3 100% polyester

During the 1980's experiments were carried out within the UK National Health Service using 100% polyester sheeting. The yarns for this material were specially textured to improve comfort and breathability and acceptance by both patients and nursing staff was obtained. The laundry industry encountered all the problems of polyester cotton sheets and the most successful solutions were found by those laundries which set up a washing process and an ironer line specifically to handle 100% polyester. This was then tuned so as to control final moisture so that the static problem could be avoided. Apart from ease of finishing and exceptionally good soil and stain removal, the other attraction of 100% polyester is a significant energy economy, both in washing and drying.

7. MATCHING UP FEEDERS AND FOLDERS

A feeding device must be capable of taking a wet, creased sheet and presenting the correct edge on to the feed bands, parallel to the front roll, so that the sheet is carried smoothly into the main body of the ironer.

The sheet must then be straightened out as it runs in and held square in exactly the same way as a human operator might do. In order to avoid distortion being pressed in, some back tension on the sheet is needed and the overall result should produce two parallel sides, at right angles to the leading edge, with the trailing edge also parallel to the first roll.

It is important that the feeder is matched to the ironer so that the sheet is presented at the correct height on to the feed bands and at the correct angle. If this does not happen then the number of mis-feeds increases and the pieces per operator hour will fall dramatically.

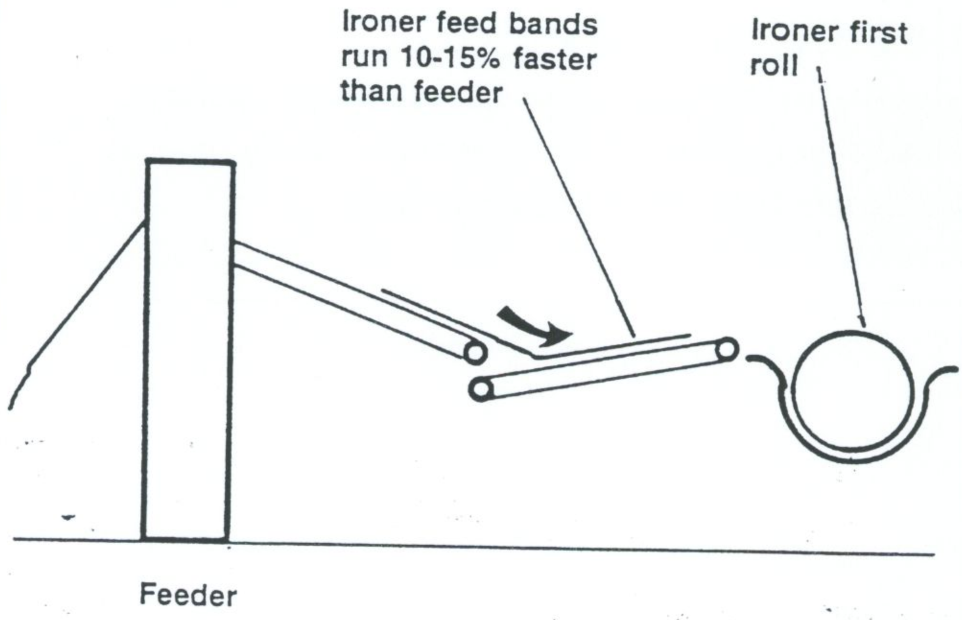


Diagram 36: Feeder to ironer transfer

When an ironer is hand fed the highest feed rates are usually achieved if the work is pre-prepared and laid up on to a suitable trolley immediately behind the feeding point. The pre-prepared work is then generally flat with the correct edge leading, making for a much smoother feeding operation. This operation can be helped if a **'scrolling roller'** spreading roll is incorporated to pull out the fabric side to side, freeing the operative to prepare the next sheet. The feeding operatives need to be capable of feeding almost edge to edge (in reality a maximum gap of about 10 cm between successive sheets). If the gap is any larger than this the ironer speed should be reduced - otherwise the sheets simply go through the ironer faster and dry less well. There is no benefit in terms of productivity in running an ironer faster than the operatives can feed edge to edge. The higher speed simply reduces drying performance under these conditions.

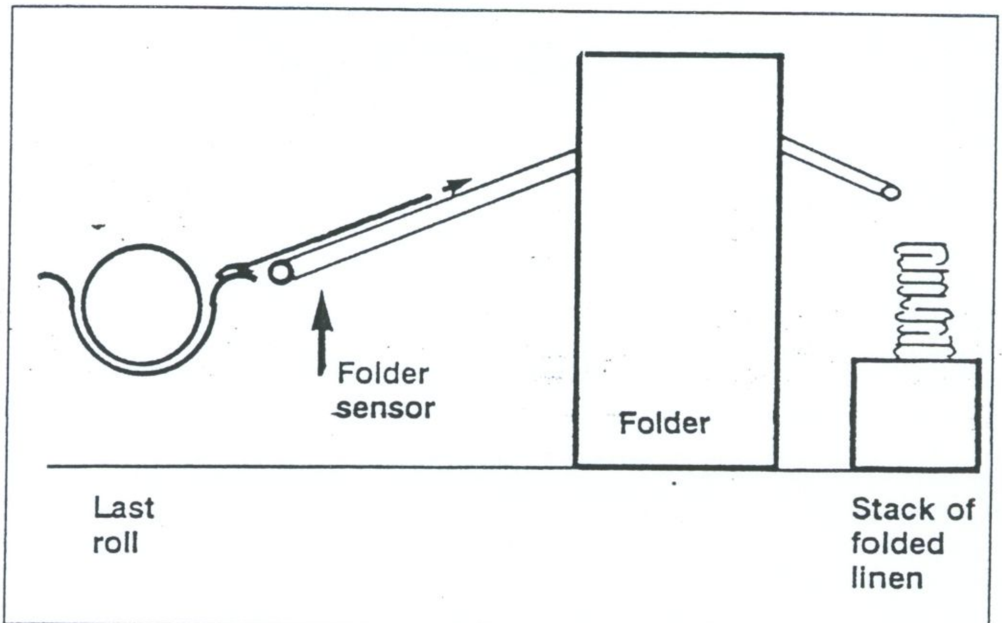


Diagram 37: Folder take off arrangement

An automatic feeder in operation will frequently **overlap** the linen being fed forward to the ironer. This is done because the leading edge helps to stabilise the trailing edge of the preceding sheet and with the speed differential between the ironer and the feeder bands then by the time the piece has entered the first roll a suitable gap of about 10cms will have developed.

Some manual feeding systems incorporate a **vacuum trough** to place back and side tension on the sheet and generally smooth out any wrinkles before it runs on to the feed bands and this also frees operatives earlier and makes for faster production.

The same principles described for feeding apply also to folding. Again it is important that work coming off the back roll is delivered at the correct height and angle for the folder to pick it up and manipulate it. If the ironer and the folder come from different manufacturers it is desirable that both suppliers guarantee the performance of their units when used in conjunction with the other. The general principle applies that the feed bands of the ironer will generally run a little faster than the supply speed from the feeder and similarly the feed bands of the folder will run slightly faster than the back roll of the ironer. These speed differentials are typically about 10-15%.

The gap between successive pieces of linen is critical to correct operation of the folder because this must be sufficient to allow the machine to reset its measuring system.

Many manufacturers specify that the centre of the first roller of the folder should be in line with the top edge of the last bed or take off plate.

8. TROUBLESHOOTING GUIDE

In this section a brief review is given of some of the common problems that occur when ironing and the causes of these.

8.1 Galling or yellowing

If all work coming off the ironer suddenly starts to develop a cloudy yellowness, this is probably due to oxidation of alkaline chemicals left behind by the wash process. This colour change occurs because of the heat in the ironer but it is normally due to poor rinsing and must be corrected at the wash stage.

8.2 Setting of stains

Stains on work coming out of the ironer generally arise because of failure to remove these at the wash stage. Some marks turn much darker because of the heat of the ironer and become almost impossible to remove. Some stains might be invisible at the feeder and only develop when the fabric is heated.

8.3 Creasing

The different patterns obtained each tell their own story when it comes to identifying the cause of a creasing problem.

Diagonal creases are usually caused by:

- poor alignment between the beds and the rolls
- inaccurate feeding so that the article goes in skew or
- has differential tension applied to it
- side to side differences in roll positioning
- side to side differences in roll diameter.

Diagonal creases at the entry to the folder are frequently caused by poor speed control of the folder feed bands.

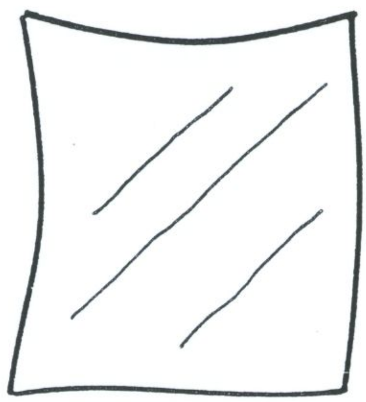


Diagram 38:

Diagonal creasing caused by side to side tension differences

Puckering or **concertina creasing** generally indicates a cold spot, excessive static or a deposit on the bed. This type of creasing can be caused by starch deposits (because of poor starching in the wash process), by excessive moisture content, by too high a bed temperature when processing polyester and by too tight a contact between bed and roll (because the clothed roll is too large in diameter or because of too high a roll to bed pressure).

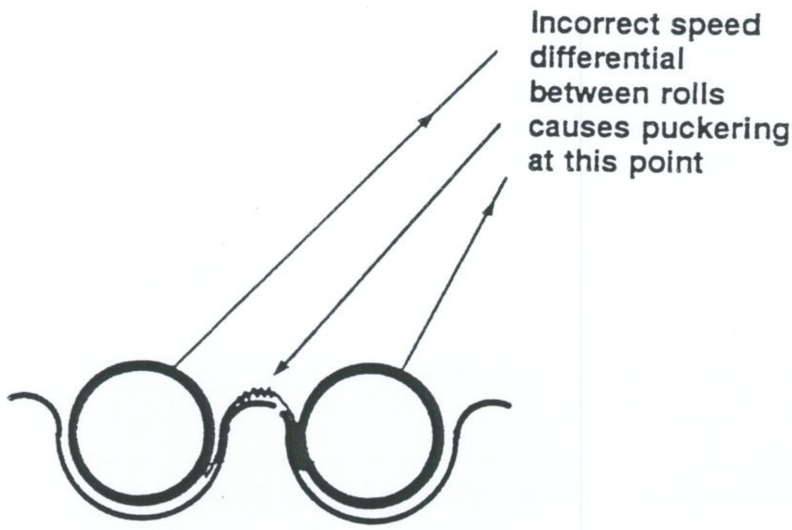


Diagram 39: Creasing because of puckering

A **wine glass shaped crease** often indicates that one or more rolls are overclothed so that bridging is occurring and the linen is nipped at the horns of the bed by the roll.

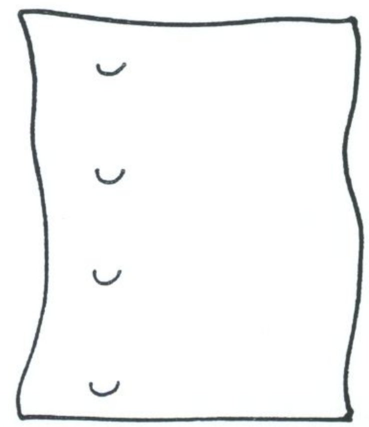


Diagram 40: Wine glass creasing caused by bridging

A **crow's foot crease** often indicates that the speed differential of the rolls is incorrect and that instead of the linen being stretched between the rolls, it is gathering and the resulting creases are being ironed in.

A **leading edge crease** can be caused by starch build up, usually about 15cm into the first bed or some other kind of deposit such as a scorched transfer. This type of crease can also be caused by a misalignment of the decreasing heights of the beds and/or gap pieces, so that instead of dropping from one to the next as the linen passes through the ironer, it is hitting a raised edge and creasing. A third cause of a leading edge crease is inconsistent clothing thickness or excessive pressure on one particular roller.

'Dog earing' occurs when both feeding operatives pull excessively on the trailing corners of the linen to produce a curved trailing edge. If only one operative does this the uneven tension produced causes severe distortion of the linen going into the folder.

8.4 Skewness

If a rectangular piece of fabric is fed squarely and evenly on to the feed bands parallel to the front roll and even side to side and trailing tension is applied then there should be no skewness in the finished article. If any of these are not correct then the fabric tends to twist and the finished article is not 'square' and cannot be folded accurately. Occasionally a poorly made sheet will have in-built skewness and will not produce a square article, no matter how well it is positioned. Side to side variation in roll diameter and hence roll to bed contact pressure will also produce skewness.

8.5 Tearing

Automatic feeders generally apply tension to the leading edge of a sheet to hold it taut and straight so that it can be lined up accurately with the first roll. If the fabric is at all weak or if the tensioning springs or rams in the feeder apply too strong a force, then the sheet will tear and be ruined. This can arise if the feeder is not reset for the appropriate width of fabric being fed. It can also occur because of failure to rinse chlorine bleach out of a fabric, causing progressive weakening of the material over five or six washes.

Tearing can also be caused by the roller speed differential being too great and it will tear the linen either completely or partially to produce a row of holes in a line across the fabric.

8.6 Deposits

Occasionally lime soap and other scummy residues from the wash liquor can be deposited at the first roll. These generally arise from attempting to wash in hard water and can be eliminated by attention to the water softener.

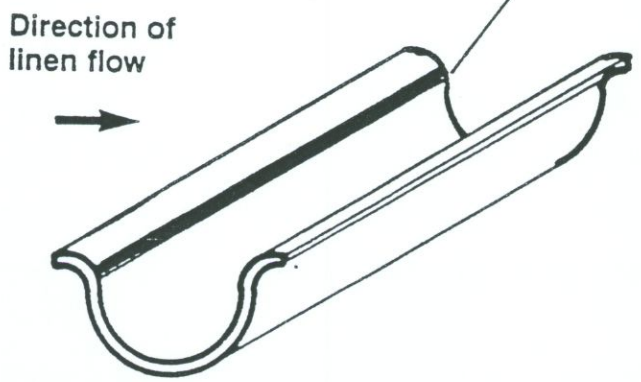


Diagram 41: Deposit on first bed

However, the main cause of deposits at the front roll is starch carry over. This can only be improved by attention to the starch rinse of the wash process and possibly by modification to the grade of starch used.

There are important safety reasons for not attempting to remove deposits at the front roll while the ironer is in motion. Serious accidents have been caused by working over an in-running nip and even though ironer speeds are low the hazard still remains. It is dealt with more fully in section 9 of this handbook.

8.7 Slow warm up

Slow warm up of an ironer is almost always due to poor steam trapping or faulty air vents. If the steam traps are too small or if they are partially blocked then the unit will warm up only very slowly - perhaps taking an hour longer than the ironer alongside. Failure to remove air swiftly from the system has a similar effect. Not only must the air vents on the horns be working correctly but the traps fitted must be designed to vent air as well as condensate and these trap vents must also be working correctly.

Wet steam, low steam pressure and steam supply pipework of too small a bore will all contribute to slow warm up.

Note: It is equally important not to try to heat up an ironer from cold too quickly. If steam is allowed to flow into the unit at high speed then whenever it hits a sharp bend or dead end the condensate wave it is pushing before it will cause water hammer and strain the ironer structure severely. This, together with the thermal shock produced by rapid change in bed temperatures, has been known to crack cast beds, smash traps and burst steel pipes.

8.8 Cold spots

If work is produced with damp patches in a consistent area or in a consistent stripe this could be due to cold spots on the bed. Cold spots generally occur where the heat transfer surface is being blocked by wetness in the steam or by a flooded bed. Cold spots can also occur at the horns or over the lower part of a bed, because of inadequate air venting.

If the roll to bed pressure is uneven for any reason (for example because the diameter of the clothed roll varies) then this will produce a stripe of dampness down every article.

8.9 Work not dry

If the performance of the ironer varies intermittently so that some damp articles come out for several minutes before dry ones are again produced, then the most common cause is variable steam pressure.

However, the occasional barrow of work with a higher moisture content than normal will also cause a problem. A quick check on the steam pressure gauge and a quick weighing of one or two sheets should quickly indicate which is the true cause so that action can be taken.

If all work starts to come off the ironer feeling damp and the fault persists then the most likely cause is a blocked steam trap or air vent or a fault on the ironer speed controller causing it to run at a speed higher than that which is set on the controller.

If the performance of the ironer falls off slowly over a period of several days or weeks, the fault could be any one, or a combination of several, of the points raised in section 5 of this handbook, which dealt with tuning. However, the first thing to check always is that the speed controls have not drifted - the fall off in performance might only be an apparent one if the actual speed is unchanged.

There are many other fault symptoms that may arise in ironing but the tips given in this section should give sufficient pointers to enable these to be tackled with confidence.

9. HEALTH AND SAFETY RISK ANALYSIS FOR IRONING

The external authorities responsible for health and safety are placing more and more emphasis on risk analysis by the user, to ensure that all unsafe occurrences are foreseen and suitable control measures implemented. The tables that follow give examples of several possible hazards and the ways in which the risks of these hazards occurring can be minimised.

Notes:

(a) Feeders and folders are not included in this risk analysis - it relates purely to the ironer itself. Designs of feeders and folders vary considerably and each type requires separate consideration. It is important to check any risks that arise as a result of a movable feeding device being brought into use and pulled back out of use, especially with regard to the electrical supply.

(b) 'Safety in Laundering Guidelines' published by the Textile Services Association, 7 Churchill Court, 58 Station Road, North Harrow (081-863-7755) provides invaluable additional guidance and further detailed information on health and safety design and engineering for ironers.

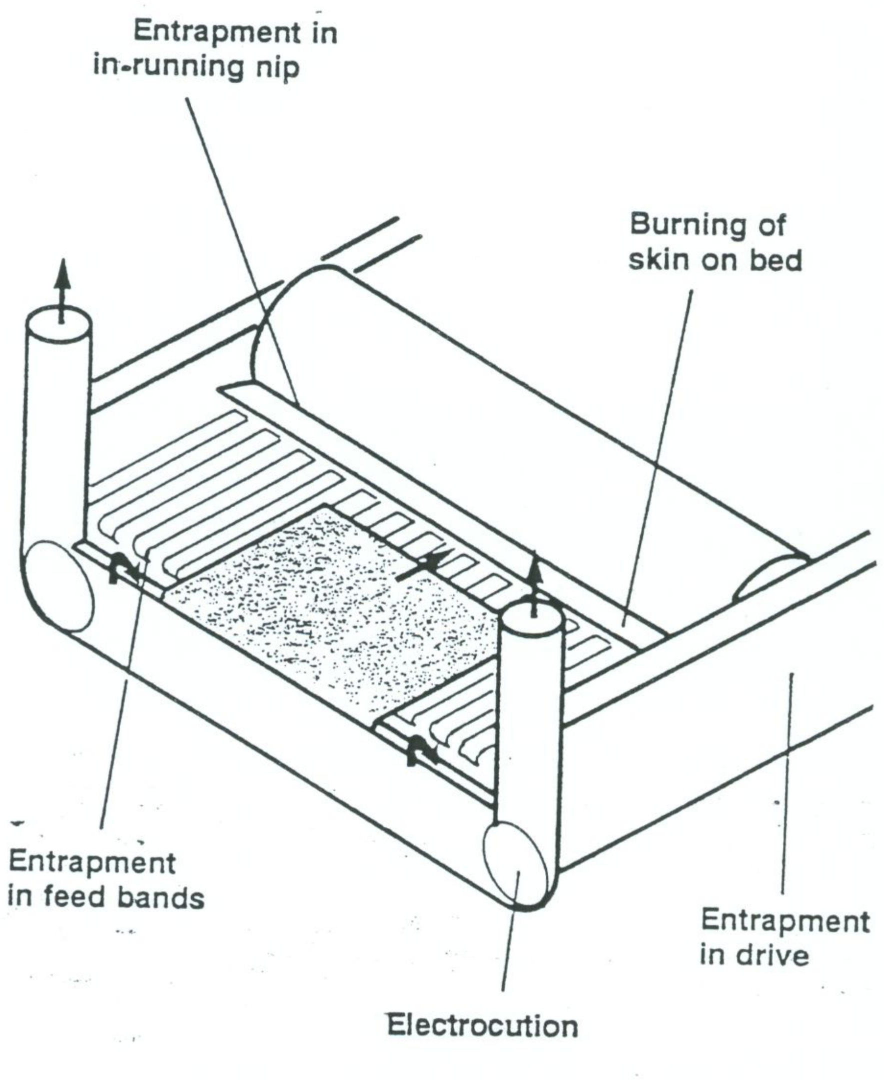


Diagram 42: Main areas of risk for ironer operation

MODEL RISK ANALYSIS FOR IRONER

Hazard	Risk of hazard occurring	Control measures	Persons affected	Comments
Entrapment of clothing (e.g. tie) or limb into the in-running nips to any roll - persons standing alongside the machine.	The risk of this hazard occurring is slight because there is no reason for any person standing at the side of the ironer to need to lean over and into it. Also the sides of the ironer are usually at least 1.2m high and 30cm wide making it difficult for a person to stumble accidentally into a nip.	1. The ironer runs at relatively low speed - normal maximum 40 metres per minute, so there is time for anything drawn in to be pulled out before damage is caused. 2. The clothing and springs are resilient so that anything pulled into the nip can usually be pulled free quite easily. 3. An emergency stop button is provided at the operator's control station and the unit is sufficiently small for the operator to be able to see and hear if anything untoward happens.	Supervisory and maintenance staff normally. Possibly an operator trying to free a damaged article without stopping the machine.	Operator and engineer training cover this risk.
Person falling from overhead into in-running nip between any roll and its bed.	The risk of this hazard occurring is considerable if overhead working is permitted while the ironer is running.	1. No person is permitted to work over the ironer while it is running and particularly not to clean off deposits or remove a trapped piece of linen.	Operators, supervisors and maintenance staff.	Operator, supervisor and engineer training covers safe clearance of debris.

MODEL RISK ANALYSIS FOR IRONER - CONTINUED

Hazard	Risk of hazard occurring	Control measures	Persons affected	Comments
Entrapment within drive mechanisms.	The risk of this hazard occurring is significant if maintenance or examination of drive mechanism is permitted whilst the ironer is running.	1. All of the drive mechanism and similar components are protected with suitable guards or are behind the side panels of the machine. 2. Guards may not be removed while the ironer is running unless an engineer is in permanent attendance. 3. Side panels may only be lifted clear by a competent maintenance engineer and then only for the purpose of inspection.	Operators, supervisors and maintenance engineers.	Engineer training covers guard removal and safe working.
Burning of the skin by contact with the beds or gaps.	The risk of this hazard occurring is significant because the heated metal beds are exposed over those areas not covered by the rolls.	1. The operator or maintenance engineer are not permitted to work over the heated bed other than in exceptional circumstances. 2. The hot surfaces are well above waist height and require conscious effort to approach them - i.e. the person has to lean right over the side frame deliberately.	Operators, supervisors and maintenance engineers.	Staff safety training covers this risk.

MODEL RISK ANALYSIS FOR IRONER - CONTINUED

Hazard	Risk of hazard occurring	Control measures	Persons affected	Comments
Burning or scalding on the steam and condensate pipework.	The risk of this hazard occurring is negligible for operators and supervisory staff running the ironer but is significant for a maintenance engineer working beneath the ironer. The risk of scalding from a fractured steam pipe or condensate pipe is very low - these pipes normally leak slightly and give plenty of fore-warning of breakage. The risk of a maintenance engineer accidentally opening a live pipe or trap is very low provided the person has been adequately trained.	1. It is general policy to insulate all hot metal surfaces on steam and condensate pipework and fittings. 2. It is common practice to repair all leaks to steam and condensate pipes as soon as they become apparent and before they can become a hazard. 3. Only trained and experienced maintenance engineers are permitted to work beneath the ironer.	Maintenance engineers. Operators.	Engineer training covers safe maintenance of steam and condensate systems and importance of maintaining insulation where it has a safety function.

MODEL RISK ASSESSMENT FOR IRONER - CONTINUED

Hazard	Risk of hazard occurring	Control measures	Persons affected	Comments
Electrocution.	The risk of this hazard occurring is significant in that the electrical load to the ironer is typically 5-40kW, three phase 415 volts.	1. The ironer is wired in accordance with electrical wiring regulations 16th edition which provides an adequate margin of safety for all staff. 2. Access to all electrical equipment requires deliberate use of a tool. 3. Access to electrical components on the ironer is only permitted to be made by a competent electrician.	Maintenance engineers. Operators.	
Beds or rolls fall unexpectedly instead of remaining in the lifted position.	The risk of this hazard occurring is significant because it depends on continuity of air pressure.	1. Locking pins are fitted to the support rams within the lifting cylinder to prevent unintentional collapse.	Maintenance engineers.	
Inhalation of asbestos fibres from old under-clothing causing lung disease.	The risk is high if old asbestos coated rolls are still in use.	1. A simple check is made by a competent person to ensure that no asbestos has been used on the ironer.	Maintenance engineers. Re-clothing team.	

MODEL RISK ANALYSIS FOR IRONER - CONTINUED

Hazard	Risk of hazard occurring	Control measures	Persons affected	Comments
Trapping hand in feed to first roll.	Risk of this occurring is high when hand feeding because there is a natural tendency to follow the sheet into the ironer to keep it straight and square.	1. The ironer is fitted with a trip which stops it before the limb which activated the trip can enter the nip. 2. The trip is designed so that it cannot be bypassed or slid under, even by a very small hand. 3. The trip is checked for function at the start of each working day.	Operators feeding the ironer.	The emergency stop button acts as a manual back-up if the trip fails. Operator and supervisor training includes daily trip check. Grasp tail of linen until trip is activated and observe ironer stops before tail enters nip.
Entrapment in in-running nip or drive during re-clothing of rolls.	This is a simple safe operation provided adequate training has been given, on the job. Otherwise the risk is significant.	1. The re-clothing team is adequately briefed and led by an experienced and competent person in a properly devised safe system of work. 2. Adequate time and resources are provided for the task to be completed in the prescribed manner.	Maintenance engineers. Re-clothing team.	

10. CONTROLLING IRONER OPERATING COSTS

Although the ironer is some three times more efficient in energy terms than a tumble drier it nevertheless has high operating costs. Because flatwork forms a large part of the work load for many plants it follows that the ironer represents a large proportion of the plant's total operating cost. The difference between the operating costs of a well tuned ironer, running at peak output and one which is poorly tuned and maintained, can be as high as three to one. This can make all the difference between adequate productivity and profitable operation and running at a loss. The points made in this section cover the principal checks needed to keep ironer operating costs under tight control.

10.1 Steam consumption

Excessive steam consumption at the ironer is caused by:

- steam leaks, especially at valves and flanges.
- steam traps and air vents leaking steam straight into the condensate main.
- inadequate insulation causing a steady unnecessary steam consumption.

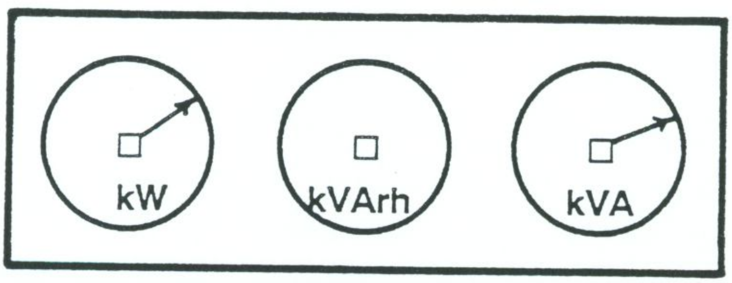
If the work being fed to the ironer contains more moisture than is necessary then the steam consumption will go up exactly in proportion and the productivity will come down similarly. It is much cheaper to remove moisture from flatwork by hydro-extraction than it is by any other means.

Hoods and **roll covers** probably have a relatively small part to play in the steam economy of an ironer. The savings they can make are usually secondary to the value of good insulation to prevent unnecessary heat loss from heated metal pipes, fittings and the undersides of the beds.

However, the attraction of fitting hoods and, to a lesser extent, roll covers is increased by the improvement they make to safety and to the workroom environment. They provide a physical barrier between the operator and the exposed part of the beds and in-running nips. They also reduce the emission of warm, steamy air into the workroom which greatly improves operator comfort, especially in summer.

10.2 Electricity consumption

There is little that can be done to minimise the **units** of electric power consumed (kilowatt hours) by the ironer other than to ensure that the waxing cloth is run at the prescribed intervals and that the ironer is fed with work at maximum throughput until it is finished and is then shut down. The electricity consumed by an idling ironer can be a significant part of the total and needs to be minimised by good planning.



Power factor at maximum demand

$$= \frac{\text{kW at maximum demand}}{\text{kVA at maximum demand}}$$

Power factor should be at least 0.95

Diagram 43:
Use of trivector meter to monitor power factor at maximum demand

The other major cost of the electrical supply to the ironer is associated with its contribution to the laundry **maximum demand** charge. This is usually measured in kilovolt amps (kVA) and is a measure of the efficiency of the way in which the electricity is consumed from the three phase alternating current supply. This efficiency is normally expressed as the **power factor**, a number between 0 and 1. A power factor of 1 is perfection and means that current is drawn from each phase exactly in balance with the alternating supply. In practice the power factor for an ironer motor is usually between 0.6 and 0.75.

Contribution to laundry maximum demand equals the power in kilowatts drawn by the motor divided by its power factor. Hence a 6 kilo watt motor with a power factor of 0.6 would contribute 10 kVA to the laundry demand.

In practice most laundries improve their power factor by connecting large capacitors across the incoming supply and these normally need to be increased in size when any new large equipment such as another ironer is added. Most laundries find it economic to improve their power factor to about 0.95 by this means.

Note: The simplest way to maintain a check on power factor is to arrange for the electricity supplier to instal a tri-vector meter which shows the maximum demand both in kilowatts and kilovolt amps. Dividing the first by the second gives the power factor at maximum demand, giving an immediate check on whether the capacitors are adequate and all working correctly.

10.3 Productivity

Because an ironer has relatively high running costs and significant depreciation the minimum operating cost is usually achieved at maximum throughput. This requires all of the tuning pointers described in section 5 of this handbook to be carried out so as to achieve maximum heat transfer efficiency. It also requires feeding and folding speeds to match the ironer capability and a good flow of correctly prepared work at the desired moisture content.

10.4 Ironer cost control

The most efficient and most effective ironers are generally controlled by teamwork, the minimum team consisting of the ironer supervisor and the relevant maintenance engineer. These are the two people who keep a natural check on the details described in this handbook to give high output and minimum operating costs. There is nothing magic about ironer management but it is certainly true that a well managed unit will return twice the output at half the unit cost of a poorly run one.

GLOSSARY

acid - a chemical solution containing plenty of hydrogen ions (H^+) such as acetic acid (laundry sour), hydrochloric acid, sulphuric acid. Acidity is measured on the pH scale from 7.0 which is neutral down to 1.0 which is highly acidic.

alkali - a chemical solution containing plenty of hydroxyl ions (OH^-) such as water containing ammonia, magnesium carbonate, sodium hydroxide. Wash liquors are usually strongly alkaline, raw water might be slightly alkaline. Alkalinity is measured on the pH scale from 7.0 which is neutral rising to 14.0 which is strongly alkaline.

anti-chlor - a chemical designed to neutralise any chlorine bleach remaining in the last rinse, which is added to prevent odours or chemical damage to linen that might otherwise occur on the ironer.

bottoming - fault caused when the roll diameter is too small for its bed.

bridging - fault caused when the roll diameter is too big for its bed.

clothing	-	the layer or layers of felt padding wrapped around the ironer roll.
condense, condensate	-	the liquid formed when steam gives up its heat.
galling	-	overall patchy yellowness usually produced by the heat of the ironer but caused by poor wash water quality or poor rinsing.
greying	-	a washing fault caused by redeposition of soiling from the wash liquor eg. because of use of hard water or too little detergent.
hydro-extraction	-	spin drying by rotating the wet linen at high speed in a perforated basket or cage.
in-running nip	-	the line where the linen is drawn into the bed by the rotating roll and at which point a finger or limb falling onto the ironer would be drawn in also, causing injury.
iron oxide	-	the chemical name for rust which is produced when any iron dissolved in laundry water is heated on the ironer to produce the characteristic brown staining.

optimum	-	best operating point taking into account all the various factors that need to be considered eg. the optimum operating speed might be that at which sheets can be fed edge to edge provided they dry properly.
partial vacuum	-	the suction produced inside the ironer roll to draw air/water vapour through the clothing.
permeability	-	the ability of clothing to allow air/water vapour to be drawn through it.
priming	-	the production in the boiler of a froth of steam and water that boils over into the steam distribution pipework, taking dirty water to the ironer.
resilience	-	the ability of the clothing to be compressed slightly by the thickness of the article being ironed and to recover completely once the article has passed through.
soft start	-	system used to avoid electrical or mechanical overload at the motor and drive system of the ironer when starting up from rest.

souring	-	the addition in the rinse of acetic acid or a similar chemical to neutralise excess alkali in the water supply so as to prevent yellow gall marks appearing at the ironer.
vegetable dyes	-	naturally occurring dyes from plants, such as the colouring found in beer, blackcurrant, beetroot, grass.
washer-extractor	-	a washing machine in which the cage can be rotated at high speed to give an adequate hydroextraction for immediate ironing. Washer extractors are generally heated rapidly by the direct injection of steam at high flowrate for a few minutes.
water hammer	-	noisy shocks produced by uncontrolled slugs of condensate hurtling through pipework, fittings and equipment.
wet steam	-	steam containing water droplets, either carried over from the boiler or produced by condensation in the pipework.

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